Pacific, now submerged, was then a continent. If so, we might further ask, is its disappearance a compensation in the earth's crust for the extensive elevation we experience here? These enquiries may never be answered, but at least they let us know that there are more things in the earth than are accounted for in our present philosophy, and all the little facts we gain bring us nearer to that ocean shore where we gaze towards the boundless horizon of the omnipotence of that God who made these things which we pry into but cannot understand.

Art. XI.—*Description and System of Working of the Flagstaff Observatory.*—By Professor George Neumayer.

[With three Plates.]

[Read before the Institute, 20th October, 1858.]

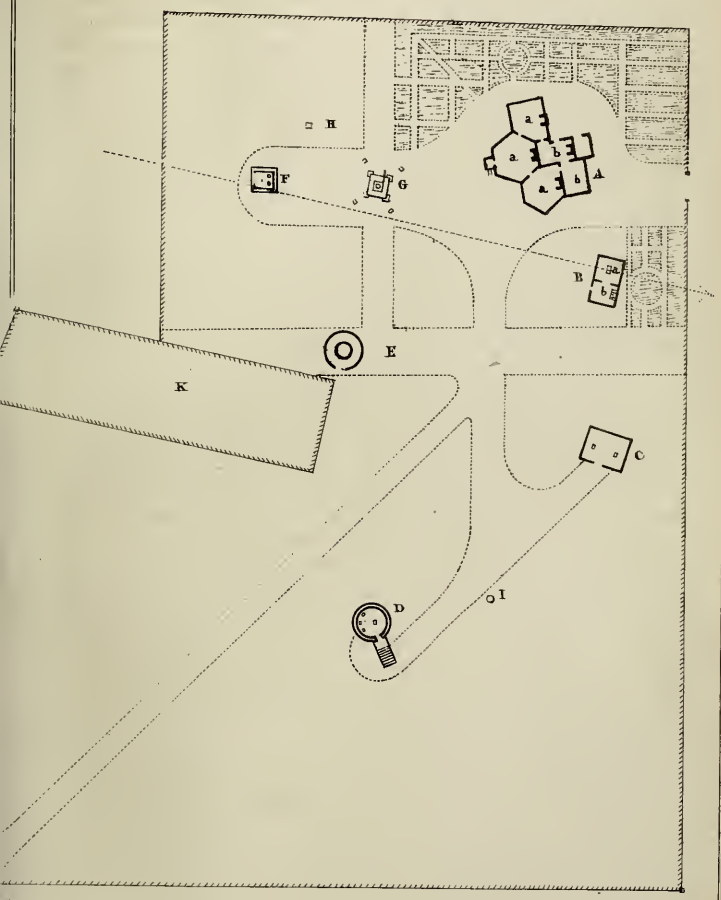
When the first proposition was made by me to the Government of this colony to establish a Magnetic Observatory, I proposed to select, for the site of the same, a spot on the southern side of the Yarra. I made that selection because the geological formations were more favourable there than on this side of the river, and preliminary observations on the magnetic elements had established the superiority of that ground over any other round Melbourne; further, the business part of the city, being more remote, was not likely to cause disturbances and inconvenience; and, lastly, the greater vicinity of the harbour was well calculated to facilitate the communication with masters of ships—an important condition required for the entire success of the Observatory.

It was only after some hesitation on my part, and after having selected two other places near that originally proposed, that I followed the suggestion made to me by the Government, to investigate the suitability of the Flagstaff Hill, with a view to making it a site for the proposed Observatory, as the buildings within the enclosure of the late signal station would be available for that purpose. The fact that the Flagstaff Hill stands upon decomposed basalt, covered to depths from 10 to 20 feet with tertiary gravel, prompted me to be cautious, and a long series of preliminary observations, made within the enclosure and on the surrounding ground,

MAGNETIC OBSERVATORY FLAGSTAFF HILL

MELBOURNE

Plate N°1



GENERAL PLAN OF THE BUILDINGS AND THE ENCLOSURE

Scale 60 feet to one Inch

To accompany Prof: Neumayer's paper read before the Phil: Inst: Oct 1858

T. E. Rawlinson Del.

Hamel & Co. imp.

A. J. Stapps lith.

showed at once that the spot was not altogether free from local disturbances, and that only the portion towards the northern limit of the hill could be made available as a spot on which to erect a house for determining the absolute values of the magnetic elements. In short, I arrived at the conclusion that the locality might be made use of, provided an addition were made to the ground of the former station; at the same time I was aware that, to give the magnetical observations their full value, an additional amount of labour would be required, of a nature calculated to keep a perpetual check on the working of the instruments indicating the horary variations. Taking further into consideration its magnificent position for meteorological observations and the propriety of selecting it as a site for an Observatory connected with nautical matters, which site is likely to facilitate the labours having for their aim a successful system of meteorology at sea, I thought myself justified in making an application for the locality as a site for an Observatory.

The facts which are calculated to illustrate this matter, and to justify my final choice, do not come within the scope of this paper, but will form part of the first printed report emanating from this institution; still I could not venture to give a description of the Observatory intelligible to every one, without introducing the subject by some remarks bearing upon the position chosen for the establishment.

Proceeding now to the object of this paper, I shall commence with the description and examination of the different buildings and contrivances which form the Observatory.

The essential parts of the magnetic department are as follows:—

The House for Observation on the horary motions in the three magnetical elements, declinations, or variation of the needle, inclination or dip of the needle, and horizontal intensity, is erected, or more properly speaking, sunk into the ground nearly in the centre of the present enclosure, (*vide* D, plate No. 1). The hill inclines towards the south-east. By placing this building in the centre, the object in view was to prevent accidental disturbances as much as possible, and still to facilitate the communication with the different other buildings of the Observatory. The foundation is laid 12 feet below the surface, and consists of strong timber; upon this are resting the double walls of a room containing the instruments for horary variations. The ground plan of the room represents a polygram of 16 sides, with a diameter of 12 feet,

and the door towards N.E. A skylight in the centre of its pyramidal roof throws the light upon the mirrors underneath, and a flight of steps leads to the surface (*vide* plate No. 2).

The stands whereupon the instruments are placed consist of sandstone, and are fixed in such a manner as to make it impossible that any motion could be communicated to them, through the floor or the walls of the house, from wind and other accidental vibrations. The principal object in placing the instruments in this underground building is to prevent sudden changes in temperature, which would necessarily have an influence upon the readings, although compensation for temperature is applied to the deflecting magnets. This object is so well attained that, while the open air shows at times a daily range of 35° F., the greatest range as yet registered in the room is 14° F., and on a common day the range is hardly exceeding 4° or 5° F.

The stone pillar carrying the tubes for the different instruments is placed nearly in the centre of the room, and a second pillar is placed outside, for the purpose of putting thereupon a collimator, for the purpose of checking the unchanged position of the tubes and mirrors intended for the registration of the instruments.

The material of this house, as well as that of the next one, is wood, and the joinings, nails, &c., are of copper and brass, iron having been carefully avoided.

The House (*vide* C, plate No. 1) for measuring the absolute values of the magnetic elements, is situated near the northern boundary of the enclosure, in a north-west direction from the former one.

The ground plan of this building is a parallelogram; the axis of the same parallel with the longer side is in the magnetic meridian, and the entrance is towards the east.

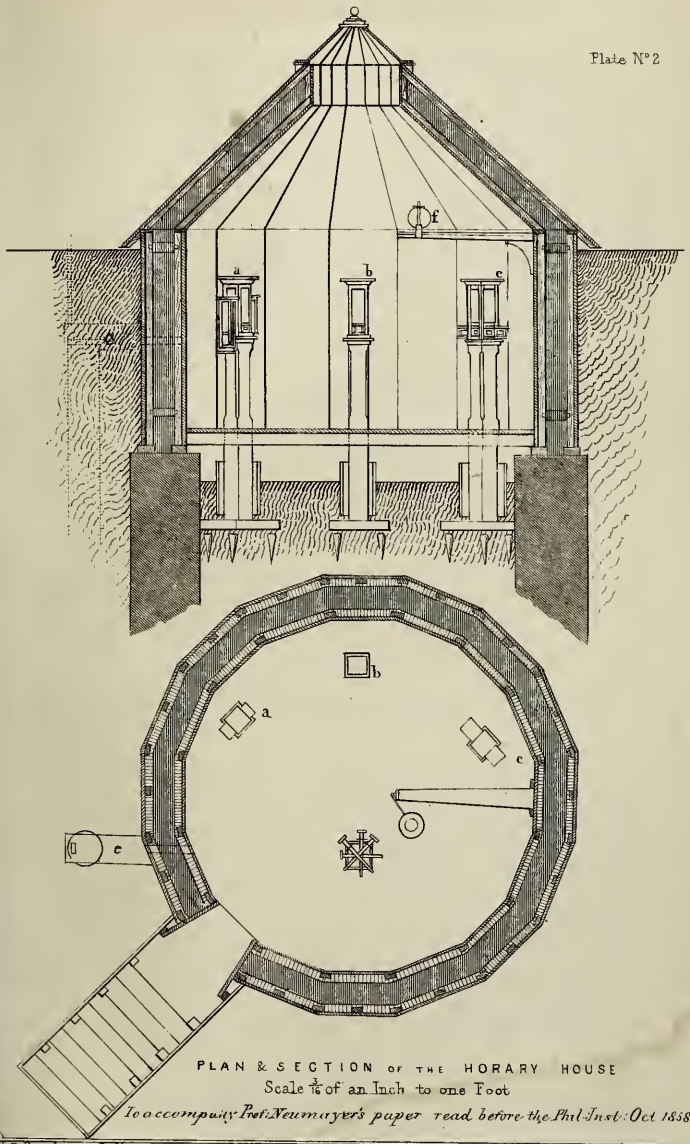
Two square stone pillars are erected in a similar way to those in the house before described.

The instruments put upon these stones are a magnetic theodolite and a dipping circle, which receive the light necessary for reading them by a large skylight in the roof of the building. Although great care was taken in erecting this room, the construction was not a matter of so difficult a nature, as changes in temperature are of no consequence in reference to the observations made therein, because such changes must be observed and brought into calculation when reducing the original readings.

The small dimensions of the magnets in use, according to

MAGNETIC – OBSERVATORY – FLAGSTAFF – HILL
MELBOURNE

Plate N°2



PLAN & SECTION OF THE HORARY HOUSE
Scale $\frac{3}{16}$ of an Inch to one Foot
To accompany Prof. Neumayer's paper read before the Phil. Inst. Oct 1858

L.E. Rawlinson Del.t
Hamel & Co. imp
Ad. Stoops Lith.

the system of instruments we have adopted, greatly facilitate the determination of this temperature, as they rapidly and thoroughly follow every change which may take place, thus preventing any serious error arising from sudden changes in which the magnets could not thoroughly participate. Different little openings are made through the walls for the purpose of enabling the observer to take bearings towards well-defined distant objects, the azimuths of which, having been once carefully ascertained, will assist us in arriving sooner at a correct value of the declination than would otherwise be possible. One of those little openings brings this house in connection with

A Little Brick Tower (*vide* E, plate No. 1), situated in the astronomical meridian passing through that pier in the absolute house which supports the magnetic theodolite. In the centre of this circular room a stone pillar is erected, upon which is placed a universal instrument, which is principally made use of for ascertaining the astronomical meridian, and transferring it afterwards to the magnetic theodolite. The instrument is placed at such an elevation as to prevent the possibility of the observer's view being obstructed when engaged in taking terrestrial objects, and the revolving nature of the roof admits of observations being made in any part of the sky, and towards any direction on the horizon.

To enable the eye to be brought to the level of this instrument, a circular flight of steps leads up to it. A second isolated pillar is erected near the steps, upon which are placed the chronometers, to bring them within reach of the observer.

The three buildings I have just described form the essential part of the magnetic observatory, in addition to which I have only to mention the computation room, to which purpose one of the rooms of the dwelling house is appropriated.

Proceeding to the further arrangements of the institution, I commence with the description of the house containing the transit room and the room for photometrical measurements (*vide* B, plate No. 1). In reference to the former I hardly need make any remark, as the construction of a transit room is familiar to every one. With regard to the contrivances for a successful management of photometrical measurements, it is chiefly required that the instrument should be placed in such a position as to admit of observations being made over the whole sky. To fulfil this requisite condition the photometer is raised upon a high stone pillar, by means of which its

mirrors are brought close to the roof, and this again can be removed, so as to expose the instrument entirely to the open air. Round the top part of the just mentioned pillar runs a stage, to which a flight of steps leads from below.

On the highest portion of the enclosure, distant from all buildings,

A Meteorological stand (*vide* G, plate No. 1, also plate No. 3) is erected. The little house, if I may call it so, which contains the thermometers, is in its principle of construction similar to that of Lawson's, but it received such alterations and additions as to make it respond to the demands of this country, in which the soil attains so high a temperature. To prevent all influences of the soil, the stand is raised upon a platform five feet above the level of the surrounding ground, the bulbs of the thermometers thus assuming a height of ten feet above the soil, the smallest distance which can be given them to prevent the effects of radiation. To protect the thermometers against sun, rain, and wind, the upper part of the meteorological stand is moveable round the flagstaff, which passes through its bottom and roof. A wooden disk, fastened to the bottom of the little house, serves as a *limbus*, with the help of which, in addition to a small quadrant attached to one of the sides in a perpendicular plane, we are enabled to ascertain, by equal altitudes, the meridian passing through the centre, thus obtaining an excellent means for registering the wind by the vane on the top of the flagstaff. A tin box, of a cylindrical form, containing the ozone paper, is hoisted up to the top of the mast for ozonometric measurements.

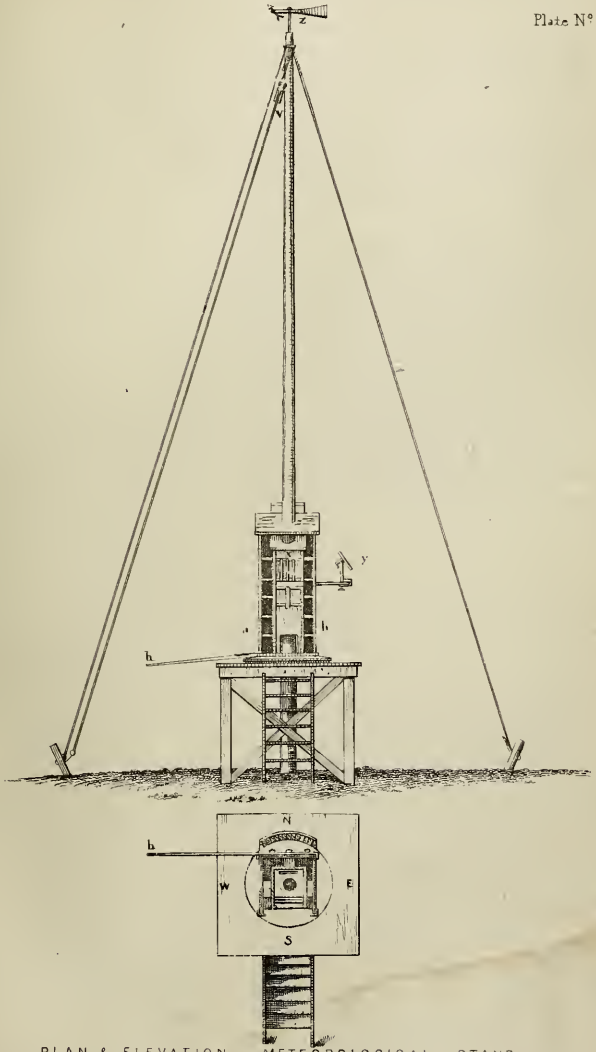
In the close vicinity of this meteorological stand, the Rain-guage (*vide* H, plate No. 1) is placed, and also the thermometer for temperature of soil and radiation; and farther towards the south arrangements have been made for correcting the sextants of captains, with regard to eccentricity and the error of division (*vide* F, plate No. 1).

The Dwelling-house (*vide* A, plate No. 1) is chiefly taken up by the offices for computation. The only apartments of particular interest are the front-room, appropriated for barometrical observations, the comparison of meteorological instruments belonging to masters of ships, and to the electric telegraph, which brings the Flagstaff Observatory in immediate connection with the Astronomical Observatory at Williamstown. In addition, a little room up stairs should not be forgotten, in which arrangements are made for electrical observations; the stand for the electrometer is fixed to the wall in a per-

MAGNETIC OBSERVATORY FLAGSTAFF HILL

MELBOURNE

Plate N° 3



PLAN & ELEVATION of METEOROLOGICAL STAND

Scale 8 feet to one Inch

To accompany Prof' Neumayer's paper read before the Phil. Inst. Oct 1858

T. L. Hamerson Del.t

A. J. Stopps Lith.